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Prevalence and Determining Factors of Urinary Schistosomiasis among Primary School Pupils in North Central Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author HIM designed the study, collected samples, performed laboratory and statistical analyses and wrote the first draft of the manuscript. Authors IY and SBS designed the study, manage literature searches, wrote the protocols and managed the analyses of the study. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Aims: This study was conducted to determine the prevalence and analyze risk factors for urinary schistosomiasis among primary school pupils in North Central Nigeria.
Study Design: The study was a cross sectional study.
Place and Duration of Study: Keffi, Nasarawa State, between March and June 2019.
Methodology: 300 urine samples (100 from each of the 3 selected primary schools) were collected from the pupils and information about them were obtained by structured questionnaires. The eggs of *S. haematobium* were microscopically detected from the samples using standard filtration technique. Data collected were analyzed using Smith's Statistical Package (version 2.8, California, USA) and *P* value of ≤ 0.05 was considered statistically significant.
Results: Out of the 300 pupils screened, 36(12.0%) were positive for urinary schistosomiasis. Ahmadu Maikwato primary school had the highest prevalence (61.1%) followed by Nurudeen (27.8%) and Model Science (11.1%) primary schools. In relation to socio-demographics, the rate of

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the infection was higher among pupils aged ≥16 years (28.6%), males (15.9%), in rural areas (12.9%), from polygamous family (16.7%) and whose parents were farmers (18.8%). Location of the pupils was found to be associated with the rate of the infection (P=0.02). However, all other risk factors considered in this study were not significantly associated with the parasitic infection (P>0.05).

Conclusion: This study indicates the presence of urinary schistosomiasis in Central Nigeria and therefore, intensified control efforts are recommended towards the elimination goal by 2025.

Keywords: Schistosoma haematobium; hematuria; school-age-children; North Central; Nigeria.

1. INTRODUCTION

Urinary schistosomiasis, caused by *Schistosoma haematobium* is characterized by hematuria, dysuria, bladder wall pathology, hydronephrosis and can also lead to squamous cell carcinoma [1]. It is a common neglected tropical disease in many rural communities in African countries, with patches of infection in the Eastern Mediterranean Region [2]. The infection is acquired usually through contact with cercaria-polluted water during swimming, washing clothes and utensils, wading or bathing [3].

In Nigeria, urinary schistosomiasis is a serious health problem with about 29 million infected cases and 101 million people at risk of infection [4,5]. Recent reports showed alarming increase of the infection in all geographical zones of the country, particularly among school children [5,6,7] leading to anemia and physical weakness and consequently reducing their ability to learn [8]. Higher rates of infection in developing countries is attributed to extreme poverty, lack of knowledge of the risks, inadequate or total lack of social amenities and poor sanitary condition [9,10].

Parasitological diagnosis of *S. haematobium* infection is readily undertaken by urine filtration and dipstick methods which detect egg(s) and micro hematuria [8].

Schistosomiasis can be prevented by improving access to clean water and reducing the number of snails [8,11] while treatment can be achieved by oral administration of praziquantel [12].

Even though schistosomiasis is still endemic in Nigeria [13,14,15,16,17], there are only few published data on the status of the infection in the current study area, where the epidemiological knowledge is rudimentary. Therefore, this study investigates the prevalence and determining factors of urinary schistosomiasis among primary school pupils in North Central Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Keffi Local Government Area of Nasarawa State, Nigeria. Keffi is approximately 68km from Abuja, the Federal Capital Territory and 128km from Lafia, the capital of Nasarawa State. It is located geographically between latitude $08^{0}03'$N of the equator and longitude $07^{0}50'$E and situated at of 850m above sea level [18].

2.2 Study Population

The study population comprises of male and female children of all age groups in 3 randomly selected primary schools in Keffi (Ahmadu Maikwato, Nurudeen and Model Science primary schools) who agreed to participate in the study. The socio-demographic information of the participants was obtained by the use of a designed questionnaire.

2.3 Sample Size Determination

The sample size for this study was determined using the formula by Naing et al. [19] for sample size calculation at 0.05 level of precision;

$$n = \frac{Z^2pq}{d^2}$$

Where:

n = derived minimum sample size if the target population is > 10, 000.
Z = standard normal deviation at the required confidence interval (1.96) which corresponds to 95% confidence interval.
p = Prevalence rate (14.7%) (0.1) [15].
q = 1 – p = 0.9
d = degree of accuracy/precision expected i.e. 0.05

$$n = \frac{(1.96)^2(0.1)(0.9)}{(0.05)^2}$$
$$= \frac{3.8416 \times 0.09}{0.0025}$$
$$= \frac{0.3457}{0.0025}$$
$$= 138.29$$
$$n = 138$$

This was however rounded up to 300 samples.

2.4 Sample Collection and Processing

Following the administration of the questionnaire, each pupil was given a 30 ml sterile wide mouth, screw-capped plastic container carrying their identification number and was instructed on how to collect the urine sample [20]. A total of 300 urine samples (100 from each of the three selected primary schools) were collected between 10:00 am and 12:00 pm. The samples were transported in a cold box to Medical Laboratory unit of Primary Health Care Kofar Pada, Keffi for analysis.

2.5 Parasitological Examination

Microscopic examination of each urine sample for detection of *S. haematobium* eggs was performed using filtration method as described by Babamale et al. [7]. In brief, 10 ml of each urine sample was drawn into a syringe and passed through a Millipore filter (12 μm polycarbonate filter) to recover the eggs. The filter was carefully examined and eggs counted at ×10 objective of a light microscope.

2.6 Interpretation of Results

Number of eggs of *S. haematobium* were counted and recorded as number of eggs/10 ml of urine and interpreted as; Low infection: < 50 eggs /10 ml of urine and Heavy infection: ≥ 50 eggs /10 ml of urine [20].

2.7 Statistical Data Analysis

The information obtained from the questionaires and results of laboratory tests were analysed using Smith's Statistical Package (version 2.8, California, USA). Descriptive Statistics were presented in tables and figure. Chi-square test was used to determine the relationships between the socio-demographic data and the prevalence of *S. haematobium*. *P* value of ≤ 0.05 was considered statistically significant at 95% confidence interval.

3. RESULTS AND DISCUSSION

The occurrence of urinary schistosomiasis among school children causes chronic infection which can negatively affect all aspects their life including health, nutrition and learning [8]. A total of 300 school pupils (100 from each of the 3 selected primary schools) in Keffi were recruited in this study. From the results, 36(12.0%) pupils were positive for urinary schistosomiasis of which 22(61.1%) were from Ahmadu Maikwato, 10(27.8%) from Nurudeen and 4(11.1%) from Model Science primary schools (Fig. 1).

Even though the overall prevalence of 12.0% reported in this study like other Nigerian studies [16,21,22] is almost similar to the national Nigerian average of 13.0% [23], higher prevalence of 53.0% has been reported in the same study area [15], 48.0% in Wamako, Sokoto State [5] and 58.1% in Abeokuta, Ogun State [24]. Higher prevalence has also been reported in other endemic countries such as Senegal (57.6%), Malawi (51.2%), Madagascar (35.5%) and Tanzania (47.6%) [25,26,27,28]. The differences in prevalence rates may be attributed to peculiar ecological characteristics, level or contact of individuals with water bodies and the degree or exposure to infective schistosoma cercariae in different locations.

The lack of significant association of *S. haematobium* infection with age and gender in this study (*P*>0.05) is an indication that regardless of age and gender, all pupils are equally exposed to cercaria-contaminated water bodies (Table 1). The higher prevalence observed among males (15.9%) aged ≥16 years (28.6%) which is consistent with other previous reports in Nigeria [5,7,16] may be because males of that age group engage more in water-related activities such as fishing, washing and swimming which increase the risk of infection with *S. haematobium.*

There was significant association between the location of the pupils and prevalence of urinary schistosomiasis in this study (*P*=0.02) as higher prevalence was recorded among those from the rural areas (12.9%) than those from the urban areas (11.8%) (Table 1). Most Nigerian studies also reported higher prevalence among rural inhabitants [7,14,15]. This is no surprise because most Nigerian rural communities are attributed to extreme poverty, inadequate or lack of social amenities such as portable water for drinking, cooking, washing and bathing [9,10] and these put them at high risk of the infection.

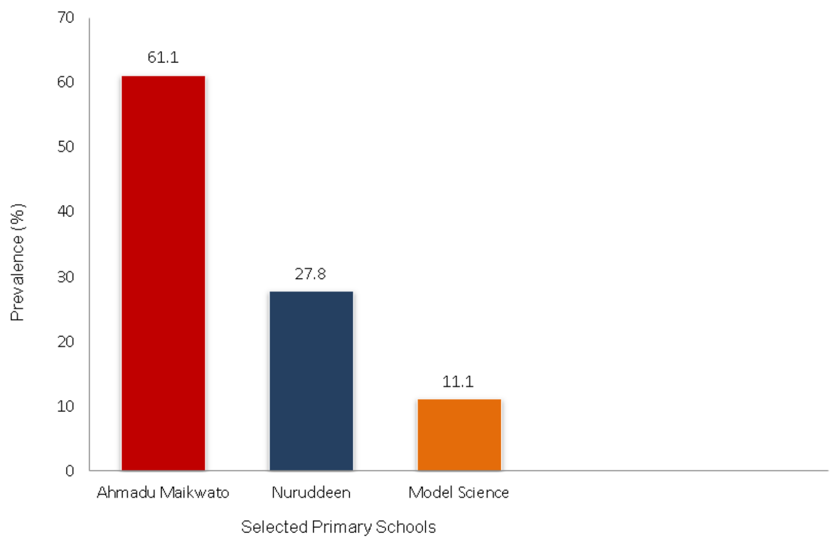

Fig. 1. Prevalence of urinary schistosomiasis among primary school pupils in North Central Nigeria in relation to schools

Table 1. Prevalence and distribution of urinary schistosomiasis among primary school pupils in North Central Nigeria in relation to socio-demographic factors

Socio-demographic	No. Examined (N=300)	No. Positive (N=36)	Prevalence (%) (Overal=12.0)	P-value
Age (Years)				
6-10	99	12	12.1	
11-15	180	18	10.0	
≥16	21	6	28.6	0.1501
Gender				
Male	170	27	15.9	
Female	130	9	6.9	0.0765
Location				
Urban	238	28	11.8	
Rural	62	8	12.9	*0.0243
Family Background				
Monogamy	210	21	10.0	
Polygamy	90	15	16.7	0.2374
Occupation of parent				
Farmer	32	6	18.8	
Civil servant	54	8	14.8	
Business	214	22	10.3	0.1607

**Statistically significant*

In relation to family background, although the difference was not statistically significant (*P*>0.05), pupils from polygamous family had higher prevalence of the infection (16.7%) than those from monogamous family (10.0%) (Table 1). Dawaki et al. [16] also reported higher prevalence among subjects with larger family size (≥10 members) in Kano State. They further suggested that the more the family size, the more the risk of exposure and transmission of the infection among family members.

Occupation of parents was also not associated with the prevalence of urinary schistosomiasis in this study (*P*>0.05). But as expected, pupils whose parents are farmers had higher prevalence (18.8%) than those whose parents are civil servant (14.8%) and those who engage in businesses (10.3%) (Table 1). These results agree with that of Okwori et al. [14] and Ezhim et al. [15] among primary school children in Northern Nigeria but disagree with that of Olusegun et al. [29] who reported higher prevalence among HIV-infected artisan in Benin City, Nigeria. The higher prevalence among pupils whose parents are farmers in this study may be because most Nigerian farmers are rural settlers who live in conditions which promotes the acquisition of the parasitic infection [9,10].

In this study, pupil's source of drinking water was not associated with infection with *S. haematobium* (*P*>0.05) (Table 2). This agrees with other findings in Nigeria [5,16]. However, Dawet et al. [30] in Jos North, Plateau State reported a significant association between schistosomiasis and source of drinking water, as subjects who obtain water from the streams and rivers were significantly more infected than those who obtain from well. Water from rivers may be contaminated with schistosoma egg from infected individuals and this may account for the higher prevalence of the infection (20.0%) among pupils whose source of water was river in this study.

It was surprising that, both swimming habit and fishing were not associated urinary schistosomiasis in this study (*P*>0.05) because, previous literatures have associated contact with water bodies with high risk of the infection [5,7,14,16,17]. However, pupils who engage in fishing had higher prevalence (16.7%) than those who do not (11.8%) (Table 2) and this agrees with the results of other researchers in Nigeria [14,15,16].

Also in this study, pupils who bath in river and/or stream had higher prevalence of the parasitic infection (20.0%) than those who bath at home (11.6%). Although the difference in the prevalence was not significant (*P*>0.05) (Table 2), pupils who bath in river and/or stream may have contacted the infection as a result of bathing with water contaminated with the parasite and hence the higher prevalence.

Similarly, we found no association between pupil's type of toilet and prevalence of urinary schistosomiasis in this study (*P*>0.05). This is an indication that all pupils are equally exposed to the parasite regardless of type of toilet. However, pupils who use toilets with water system had higher prevalence (14.7%) than those with pit toilets (10.7%) (Table 2). Dawaki et al. [16] also reported similar results among Hausa communities in Kano State, Nigeria.

Table 2. Prevalence and distribution of urinary schistosomiasis among primary school pupils in North Central Nigeria in relation to possible risk factors

Risk Factor	No. Examined (N=300)	No. Positive (N=36)	Prevalence (%) (Overall=12.0)	P- value
Source of drinking water				
River	10	2	20.0	
Well	31	4	12.9	
Borehole	165	20	12.1	
Tap	94	10	10.6	0.5382
Swimming habit				
Yes	102	11	10.8	
No	198	25	12.6	0.0810
Fishing				
Yes	12	2	16.7	
No	288	34	11.8	0.3055
Bathing Habit				
River/Stream	15	3	20.0	
Home	285	33	11.6	0.1588
Type of Toilet				
Pit	205	22	10.7	
Water System	95	14	14.7	0.0604
Regular house chore				
Fetching water	147	21	14.3	
Washing	68	6	8.8	
Sweeping	85	9	10.6	0.2063

Higher prevalence of infection with *S. haematobium* was recorded among pupils who fetch water regularly in this study (14.3%) than those who sweep (10.6%) and wash (8.8%) regularly. Even though the difference in prevalence was not found to be statistically significant ($P>0.05$) (Table 2), fetching water may be from the river, stream or pond which may likely increases the risk of contact with water contaminated with the parasite. Babamale et al. [7] also reported higher prevalence of the infection among those with regular contact with water in rural communities of Kwara State, Nigeria.

4. CONCLUSION

The recorded prevalence of the parasitic infection in this study (12.0%) is still within the national Nigerian average indicating that the infection is still endemic in the country. Hence, mass chemotherapy, provision of health education, safe water supply and sanitation facilities especially in rural communities are highly advocated to facilitate schistosoma elimination in the year 2025 as contained in the United Nations global goals for sustainable development.

CONSENT

All pupils included in this study completed and signed an informed consent form with the help of their teachers.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have been conducted in accordance with the ethical standards laid down in the 1975 Declaration of Helsinki. Ethical approval to conduct this study was obtained from the Research Ethics Committee of Federal Medical Centre Keffi. Approval was also obtained from the Local Government Council Education Authority, the Authorities of the various schools as well as from the pupils used for the study.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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